Ambler Mining District Access

DRAFT

CONCEPTUAL
PORT COST EVALUATION REPORT

February 2012

AMBLER MINING DISTRICT ACCESS

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LIST OF ACRONYMS

DMTS....DeLong Mountain Transportation System
DOT&PF....State of Alaska Department of Transportation and Public Facilities
Shell....Royal Dutch Shell
USACE....United States Army Corps of Engineers
USCG....United States Coast Guard
USBM....United States Bureau of Mines

EXECUTIVE SUMMARY

The Ambler Mining District Access project will identify, design, and construct a transportation corridor from Ambler mineral belt to either a port location on the west coast of Alaska or the surface transportation system in Alaska's Interior. The project objective is to provide surface transportation access to state lands and facilitate exploration and development of mineral resources along Ambler mineral belt.

The project study area extends from Ambler mineral belt south to Nenana and from the Dalton Highway to the west coast of Alaska. Six potential road corridors (routes) were identified within the project study area. One corridor, Brooks East, was further analyzed with an aerial investigation and consultation with the National Parks Service to develop five additional variations of the corridor. A total of eleven road corridors were included in the reconnaissance and evaluated in the Summary Report (DOWL HKM, 2011a). Three of those corridors end at potential port sites on the west coast of Alaska.

This report provides order-of-magnitude cost estimates for three port development sites on the Bering Sea coast. The ports were examined for their ability to export mineral resources from Ambler mineral belt and other region mineral districts to world markets.

The three potential sites are DeLong Mountain Transportation System at Red Dog Mine near Kivalina; Cape Blossom, 12 miles southeast of Kotzebue; and Cape Darby, 60 miles east of Nome. Arctic port economic feasibility is primarily a function of distance between potential mineral developments and port sites relative to the volume/value of mineral exports in addition to site conditions and costs. Open ocean season length can play a role in feasibility as well, with DeLong Mountain Transportation System and Cape Blossom open three to four months a year and Cape Darby open up to six months a year. Other metrics, including inbound industrial and consumer products, generally do not play a major economic role in port feasibility considerations.

Each of the port sites has advantages. DeLong Mountain Transportation System has existing systems in place for Red Dog Mine ore shipments and a parallel barge operation could be constructed for Ambler mineral belt ore storage and transshipment. Cape Blossom, likely a barge-only operation due to shallower approach depths, is close to utilities and services and these have ancillary benefits to the community and region. Cape Darby is a superior site for a ship port. A substantial challenge in all cases will be crossing federal conservation units with road or rail infrastructure to access the selected port site from Ambler mineral belt.

The determining factor in port selection is the likely volume of ore concentrates moving from the mining district. If the volume is comparable to Red Dog Mine, a barge-based operation at DeLong Mountain Transportation System is likely the most practical solution to ore transshipments. A barge-based lightering system is a successful low-cost method for ore transshipment in the limited season, shallow draft Bering Sea environment. However, if ore volumes increase substantially, lightering cycle times may become a limiting factor. The port operator and industry could make a decision that there is a need for a direct ship-based transshipment system at the port. This would involve an approach channel, turning basin, and ship dock. If it is determined that a direct ship loading method is needed to address volumes moving through a port site, DeLong Mountain Transportation System is still likely the most practical site overall. While Cape Darby has a longer potential shipping season and deep water nearshore, it is far removed from developments and services that would create the base for cost-effective operations.

As reviewers study this report, they should not focus too keenly on cost alone. Other factors will also determine the most desirable port location. For example, Cape Blossom is considerably closer to Ambler mineral belt than Cape Darby. So, the cost of a roadway to Cape Blossom is much lower than the roadway cost to Cape Darby. However, the Cape Blossom site will have ongoing dredging and lightering costs not associated with the Cape Darby site. In addition, the Cape Darby site has open water for an additional two months, compared to the Cape Blossom site. Many questions with significant cost impacts remain to be answered. For example, the type of dock and length of dock may be refined as engineering progresses. A summary of port site development components and their associated costs are provided in Table ES-1.

Exhibit ES-1: Summary of Estimated Port Cost and Components

Description		DMTS Ship-Based	DMTS Barge-Based[3]	Cape Blossom[3]	Cape Darby
	Ore Storage Buildings[1]	$65M	$65M	$65M	$65M
	Yard and Support Facilities	$10M	$10M	$10M	$10M
	Conveyor; Equipment and Installation	$10M	$10M	$10M	$50M
	Access Road	NA	NA	$35M	$15M
Onshore Development	**Subtotal**	**$85M**	**$85M**	**$120M**	**$140M**
	Dredging, First Cost	$70M	$50M	$20M	NA
	Dock	$30M[4]	$20M[4]	$20M	$15M
	New Barge	NA	$20M	NA	NA
	New Tug	NA	$5M	NA	NA
Offshore Development	**Subtotal**	**$100M**	**$95M**	**$40M**	**$15M**
	PRE-CONTINGENCY TOTAL	**$185M**	**$180M**	**$160M**	**$155M**
	Contingency[2]	40%	20%	60%	65%
	Total Contingency	$75M	$35M	$95M	$100M
ESTIMATED TOTAL CONSTRUCTION COSTS		**$260M**	**$215M**	**$255M**	**$255M**
ESTIMATED TOTAL ANNUAL MAINTENANCE COSTS		**$14M**	**$15M**	**$12M**	**$10M**
	Annual Onshore Maintenance and Operations	$3M	$3M	$4M	$4M
	Annual Offshore Maintenance and Operations	$11M	$12M	$8M	$6M
Barge Haul Distance		1 mile	1 mile	6 mile	0 mile
Distance to Ambler Mineral Belt		260 miles	260 miles	250 miles	330 miles
Months of Open Ocean Season		3 to 4	3 to 4	3 to 4	6

Note: Onshore and offshore development costs have been rounded to the nearest $5M.

1 Cost does not include mobilization and demobilization or access. These costs are reflected in the engineering uncertainty contingency.

2 Contingencies include; engineering uncertainty, management, administration, and owner contingency. See page A-3.

3 Does not include ongoing costs for lightering.

4 The square foot dock cost applied at the Cape Darby and Cape Blossom sites was determined through conversations with two experienced Alaskan port engineers. However, the square foot dock cost for the DeLong Mountain Transportation System site found in the source referenced Navigation Improvements, Draft Interim Feasibility Report, DeLong Mountain Terminal, Alaska, Volume I (United States Army Corps of Engineers, 2005) is significantly higher. To allow for an equal comparison, the square foot docks cost applied to Cape Darby and Cape Blossom ($1,000/square foot) was also applied to the DeLong Mountain Transportation System docks. For more information, see Appendix A.

DMTS = DeLong Mountain Transportation System

1.0 INTRODUCTION

1.1 Project Overview and Purpose

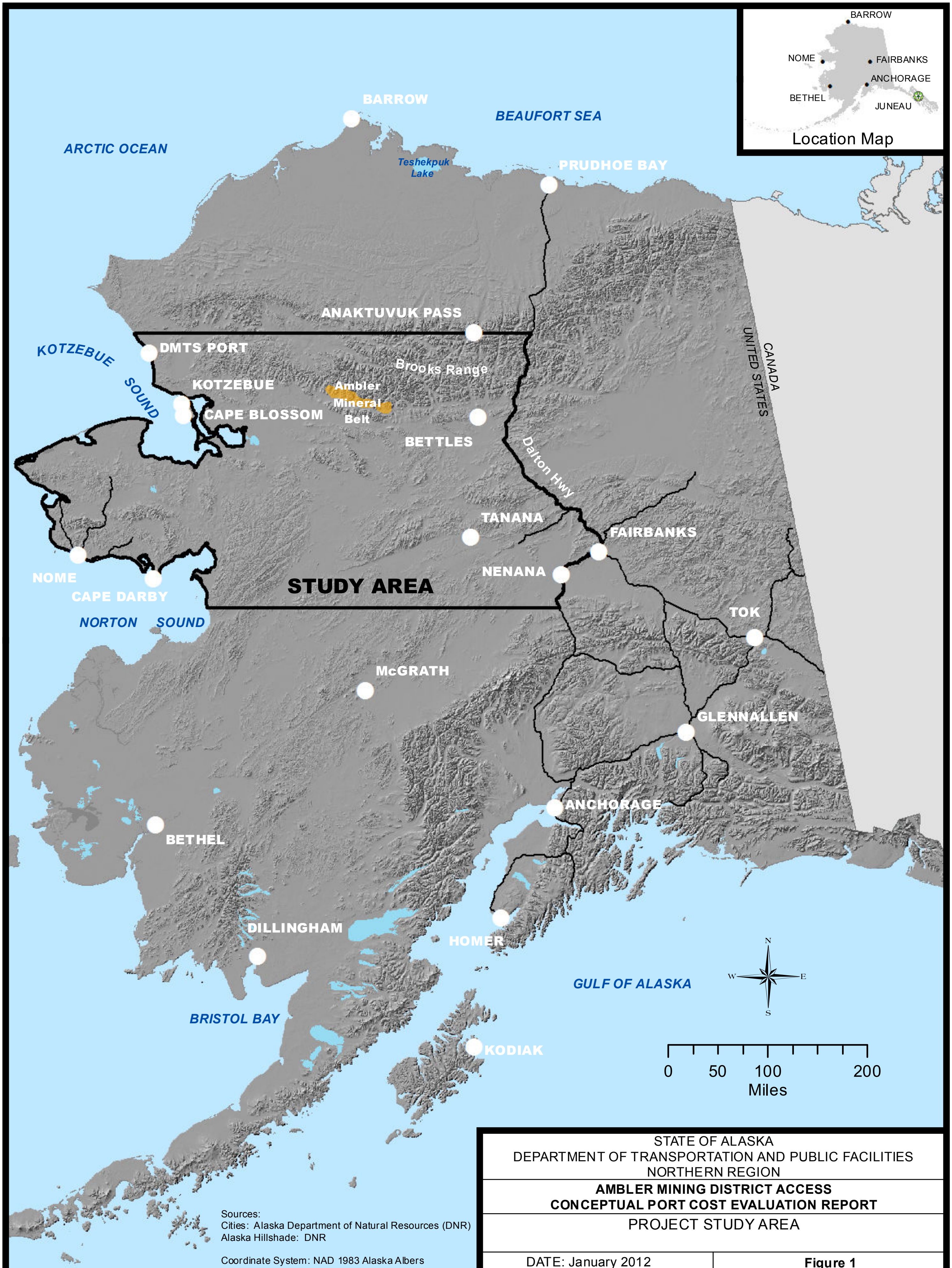
The South Flank of the Brooks Range contains extensive mineral resources. Limited exploration efforts since the 1950s have identified significant resources of copper and other base metals (Hawley and Vant, 2009).

The State of Alaska Department of Transportation and Public Facilities (DOT&PF) has initiated the Ambler Mining District Access project to identify, design, and construct a transportation corridor from Ambler mineral belt to either a port location on the west coast of Alaska or a surface transportation system to Alaska's Interior. Road and rail options are being evaluated and the initial analysis of access options is documented in the Summary Report (DOWL HKM, 2011a). The project objective is to provide surface transportation access to state lands and facilitate exploration and development of mineral resources along Ambler mineral belt. Cost estimates for the initial access options are included in the Summary Report.

The access routes that head eastward from the Ambler mineral belt all connect to existing infrastructure (road or rail) in Alaska's Interior, whereas the western routes connect to potential future or expanded port sites on the Bering Sea coast. The cost estimates included in the Summary Report have only included costs for the overland portion of the transportation infrastructure. In order to provide a more complete and realistic comparison of costs for each access option, this report documents conceptual port elements and order of magnitude cost estimates for each port site. Combined with the costs in the Summary Report, these port estimates enable a more complete comparison of the primary transportation infrastructure that would be required for each access option.

1.2 Overall Project Study Area

The project study area for the Ambler Mining District Access study extends from the southern face of the Brooks Range southward to Nenana and west from the Dalton Highway to Alaska's west coast (Figure 1). Eight potential access corridors were initially identified within the project study area; Brooks East Corridor, Kanuti Flats Corridor, Elliot Highway Corridor, Parks Highway Railroad Corridor, DeLong Mountain Transportation System (DMTS) Port Corridor, Cape Blossom Corridor, Selawik Flats Corridor, and Cape Darby Corridor (Figure 2). All eight corridors begin in the vicinity of Ambler mineral belt just north of Kobuk.



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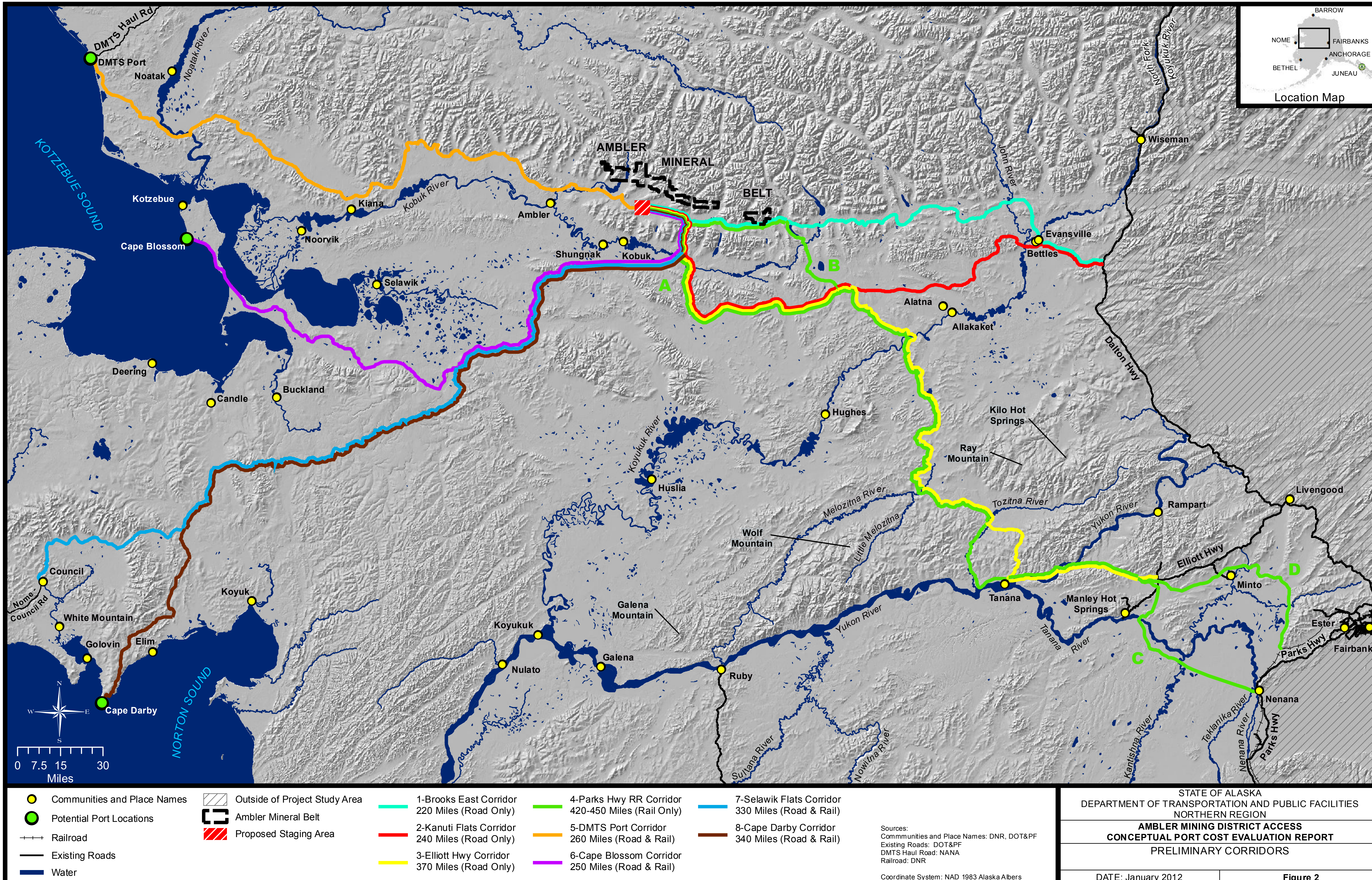

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1.3 Port Sites and Operations

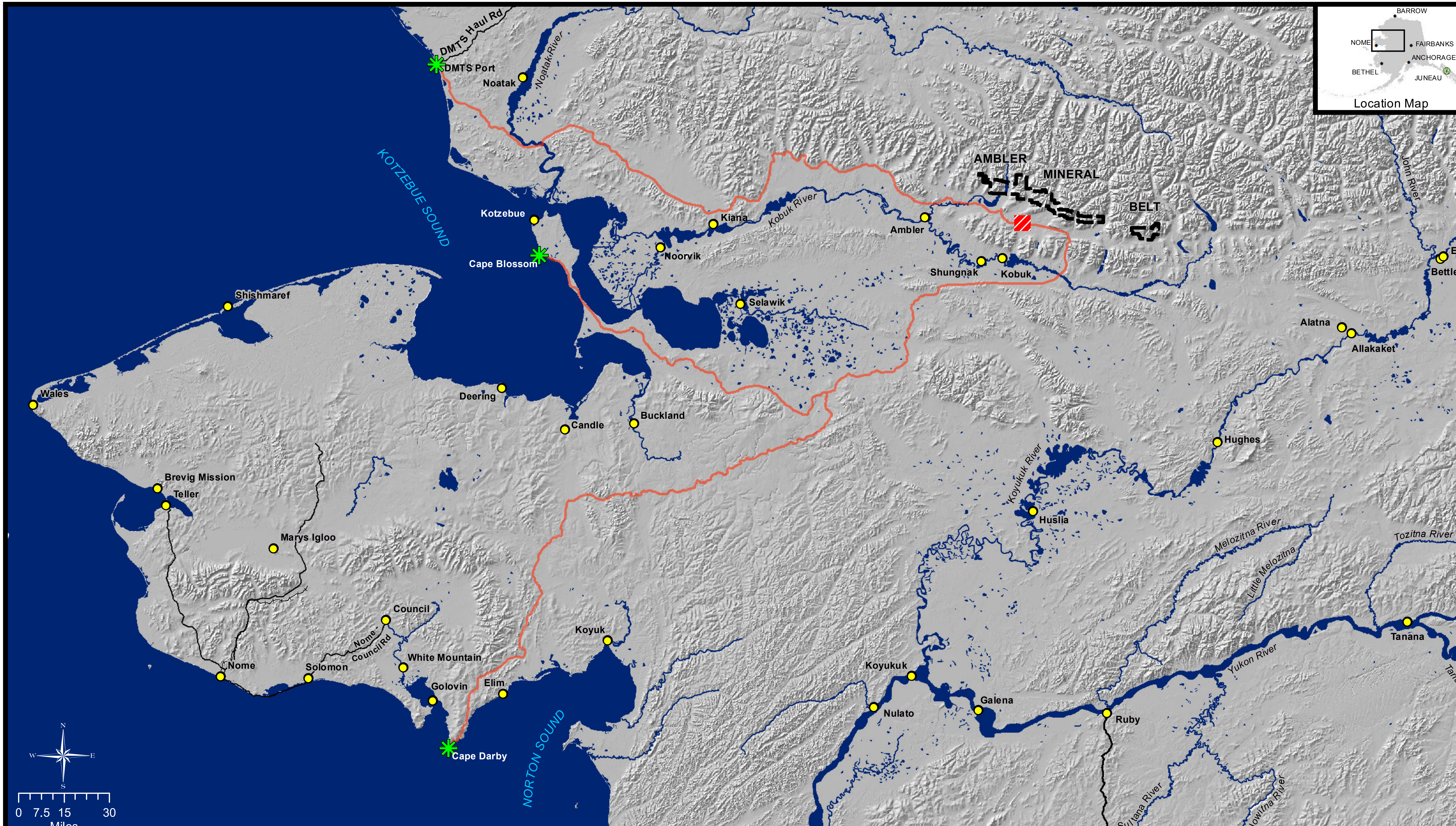
This Draft Conceptual Port Cost Evaluation Report includes a review and updated order-of-magnitude cost estimates for each of the port sites associated with the western corridors. These sites include a proposed new port at Cape Darby, a proposed new port at Cape Blossom, and an expanded port facility at the DMTS port site near the Red Dog Mine (Figure 3).

Two types of port operations, a barge lightering system and a direct transfer ship port system, are evaluated in this report. A barge-based lightering system, similar to the one in use at DMTS, is a cost-effective transfer method for low volume ore transshipment for the shallow depths found at this port site and many other areas along the Bering Sea coast. The advantage of the lightering method is its lower capital and operations costs in a shallow water environment; its disadvantage is the longer transshipment cycles that can restrict volumes moved during the short Bering Sea open water season. A direct transfer ship port requires a ship-capable dock site and does not require lightering between the ship and the onshore facilities.

2.0 AMBLER MINING DISTRICT ACCESS AND HISTORICAL EVALUATIONS

Access for exploration and development in Ambler mineral belt is dependent on air travel. The closest road network is the Dalton Highway, approximately 200 miles to the east. The closest potential marine access site is 250 miles to the west at Cape Blossom. Marine facilities along the coast are limited. Along the northwest coast, goods must be lightered off barges to Kotzebue and then transported on river barges to the upper Kobuk Valley. Although river barge access to the upper Kobuk Valley is usually available in July and August, water conditions are often shallow. When accessible, the shallow-draft barges are not capable of transporting heavy equipment and other materials needed for resource exploration and production. Limited payload capacity, combined with the short barge season and lack of reliable access due to marginal river depth, essentially makes access for exploration and development dependent on air travel.

Known mineral resources in Ambler mineral belt have resulted in numerous studies of potential port sites over the last 30 years. Past studies have evaluated potential ports at the DMTS and Cape Blossom sites. These existing port studies were reviewed as part of this port cost evaluation process and are listed in Chapter 6.0.



Communities and Place Names

Potential Port Locations

Existing Roads

Water

Outside of Project Study Area

Ambler Mineral Belt

Proposed Staging Area

Western Preliminary Corridors

Sources:
Commmunities and Place Names: DNR, DOT&PF
Existing Roads: DOT&PF
DMTS Haul Road: NANA

Coordinate System: NAD 1983 Alaska Albers

STATE OF ALASKA
DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES
NORTHERN REGION

AMBLER MINING DISTRICT ACCESS
CONCEPTUAL PORT COST EVALUATION REPORT

POTENTIAL PORT LOCATIONS

DATE: February 2012 | **Figure 3**

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3.0 BACKGROUND

The Arctic Ocean and Bering Sea have recently become high priority regions for the United States. As these waters become more ice free, the regions become more important for national defense, ocean shipping, oil and gas developments, and Alaska mineral exports. Based on these global considerations, the United States government may have an interest in helping to fund Port development in western Alaska.

3.1 National Defense

The United States World War II and Cold War military strategies resulted in a series of overland routes to and through Alaska, and air bases throughout Alaska. Recently there has been growing international activity in the increasingly open waters of the Arctic Ocean and Bering Sea including oil, gas, and mineral developments. The potential for Arctic boundary challenges has encouraged the United States to deploy national defense assets to the region. Russia has made similar efforts over the last decade. Globally, there are a growing number of actions by Arctic countries to solidify and protect national interests and to exploit natural resources in the Arctic.

Surface ships have two needs that can be fulfilled from land-based facilities. One is all-season port availability. Unalaska/Dutch Harbor meets this need, but is a four-day run from the Bering Strait. The other need is for deployed vessels to routinely access fuel, food, and personnel transport. Once a larger force is established in the Arctic, at-sea resupply is a likely scenario. Land-based assets can be deployed to active or reactivated military sites, or be deployed to new sites, like the proposed Barrow-based United States Coast Guard (USCG) air station. In the meantime, as the USCG begins to upgrade its mission in the Arctic and the United States Navy begins to define its mission, local resupply is the most likely option. The local resupply option has resulted in efforts by Nome, Kotzebue, and others to be that resupply point. It is likely that in all cases, short-to-medium term resupply and personnel transport will occur with lightering vessels out of Nome and Kotzebue, since no ports are currently of sufficient depth to service the larger USCG cutters.

3.2 Ocean Shipping

The shipping season in the Arctic is increasing, resulting in more vessel traffic that will need to be serviced. Two issues stand out. The first is the need for transshipment points along the Great

Circle Route. These would form the pivot points for freight going to and from Europe and Asia, to the United States west coast, and to the newly expanded Panama Canal. Adak and Unalaska/Dutch Harbor are two candidates for this type of transshipment port facility. Adak holds an edge because of its remarkable staging capacity. The second issue is the need for distressed vessel and spill response. While Dutch Harbor and Unalaska can provide some services, there will also likely be a need for shoreside facilities along the Bering and Chukchi Sea coasts. These needs can be met in the short-to-medium term through stationed vessels. In the long term, port developments will likely be necessary.

3.3 Oil and Gas Developments

Oil and gas exploration and development is the third element of the new push into the Arctic Ocean and Bering Sea. Royal Dutch Shell (Shell) intends to move into the United States side of the Chukchi Sea in the next few years, and other operators are likely to follow Shell there and to the Beaufort Sea. Russia is also moving into its eastern Arctic areas. The recent sinking of the drilling vessel, Kolskaya, west of the Bering Sea, is evidence of their rush to develop Arctic petroleum resources. The incident has added to Arctic countries' concerns about the need to preempt territorial overreach and to set circumpolar safety and environmental standards associated with oil and gas development.

The United States effort is more methodical, as evidenced by the several years of effort needed to get permits and vessels developed for exploration work. But the United States push to open the Arctic region is real. Shoreside facilities associated with oil and gas development may include distressed vessel and spill response capabilities, although it is likely in the near-term that private sector service vessels will respond to these events. These developments overall are likely a function of private developments, but public sector coordination of port developments with the industry is ongoing and substantial.

3.4 Alaska Mineral Exports

Transshipment of coal and ore concentrates from Alaska mines remains a minor element of this new Arctic effort, although efforts to develop mineral export ports have a long history. Until recently, a 100-mile circle model as the feasible distance limit between mines and port developments has held true. This model was first presented in the Analysis of Bethel, Kivalina (Red Dog) and Omalik Lagoon as Port Sites for use by the mineral industry (United States

Bureau of Mines [USBM], 1990). It is evidenced by the success of the Red Dog Mine and the absence of other Arctic mine developments. Recent high commodity prices and increased world demand overall has potentially altered this formula and is the basis for the current port review.

4.0 CURRENT PORT DEVELOPMENT EFFORTS

Modern port development efforts began with the Western and Arctic Alaska Transportation Study (Louis Berger and Associates, 1981). Later, several United States Army Corps of Engineers (USACE) studies and especially the resource development navigation study by the USBM added to the development effort. Private sector analyses for Red Dog port development also made contributions. Studies of potential port sites have continued to the present, with recent analyses by the DOT&PF, Alaska Industrial Development and Export Authority, and the USACE.

Two sites, DMTS and Cape Darby, have consistently been candidates for port development over the years. Cape Blossom in Kotzebue was identified as a potential candidate in the early 1990s. Of these, DMTS, 260 miles from Ambler mineral belt, is the only port that has been brought on line. It is a barge-based lightering dock that meets Arctic port development principles for mineral export. These are: (a) an exceptionally high-value mine, and (b) a mine located within 100 miles of the coast. While the DMTS barge-based port operations and short shipping season (3 to 4 months) present challenges, it is a serviceable site for the current and proposed operations at the Red Dog and satellite mines in the region. The port could be converted to a ship-based system with a dredged channel and a new dock, if future demand warrants. In the short term, another barge dock could lighter Ambler mineral belt ore concentrates to ships offshore at significantly lower port development costs.

The Cape Darby port site, when looked at from a ship operations standpoint, is an excellent location. It has deep water close to the shoreline and up to six months of open water for shipping operations. It is 330 miles from Ambler mineral belt - roughly 80 miles further than DMTS or Cape Blossom. A comparable distance-to-volume/value relationship would likely show Cape Darby is clearly the superior site along the Bering Sea coast for mineral export. However, it is important to recognize that the remote and undeveloped site carries substantial costs for onshore development.

The Cape Blossom site is the newest of the three sites in terms of analyses and promotion. It is 250 miles from Ambler mineral belt to the Cape Blossom site. This site is a solid contender for an Ambler mineral belt mineral transport port if the economic relationship between distance-and-volume/value relationship is practical. The site is near a community with existing jet service and onshore development costs would likely be lower than those at Cape Darby. The challenge at this site is its restricted depth, likely 24 feet, which is suitable for mainline barge service, but is not practical for the 35-foot ship depths needed for direct transshipment.

5.0 PORT SITE DESCRIPTION AND COST ESTIMATES

This section includes potential port site descriptions; order-of-magnitude cost estimates, and the advantages and disadvantages for each site. All port sites would likely require ore concentrate storage facilities like the ones at Red Dog Mine (Figure 4).

Figure 4: Typical Storage Facility (Red Dog Mine)

5.1 DeLong Mountain Transportation System Port Site

5.1.1 Site Description

DMTS is located 7 miles south of the village of Kivalina, 25 miles north of the village of Noatak, and 260 miles from Ambler mineral belt. The current port is a barge-based lightering operation that transfers zinc concentrates from Red Dog Mine to ships waiting one mile offshore (Figure 5). The port typically operates three to four months during the summer depending on weather and ice development and movement. Ore concentrates are stored in warehousing structures during the year to facilitate transfers during the open water season. Ore from this site is shipped primarily to British Columbia and Asian smelters. An upgraded port facility could include a 1,450-foot trestle structure plus a dredged channel and turning basin to accommodate 45-foot draft vessels (Figures 6, 7, and 8). Since the dredging required for ship-based operations is extensive, a barge-based expansion was also evaluated.

Figure 5: Existing DeLong Mountain Transportation System Port Site Facilities

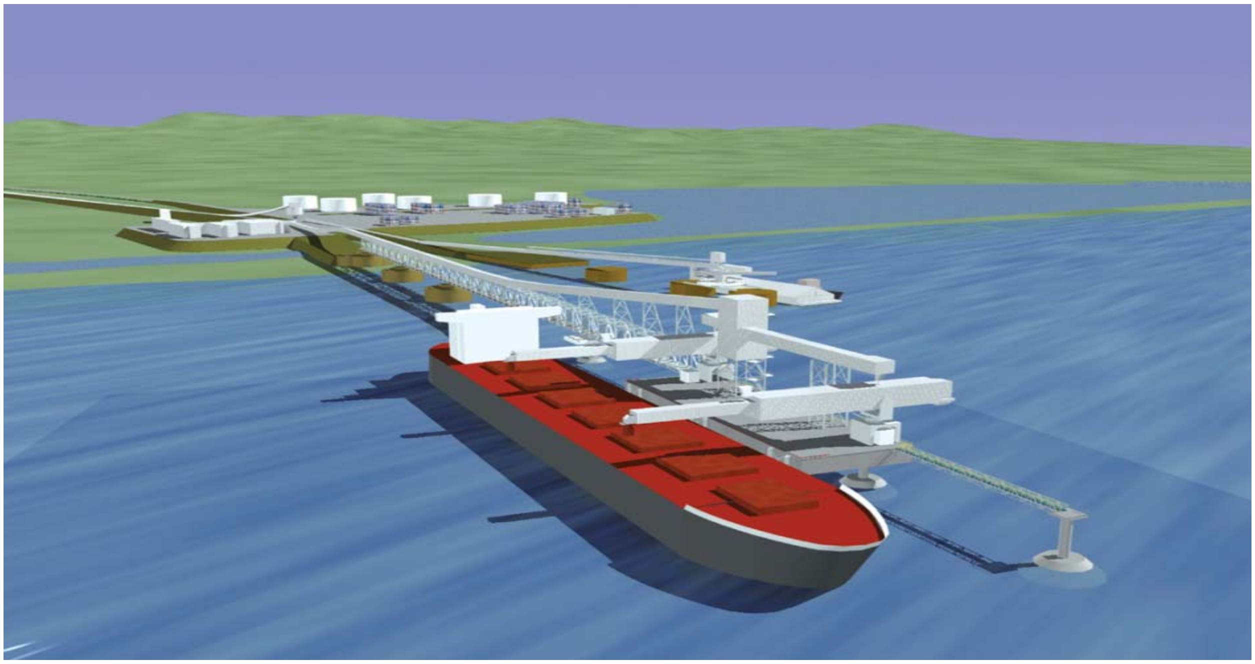

Figure 6: Potential Upgrades to DeLong Mountain Transportation System Port Site

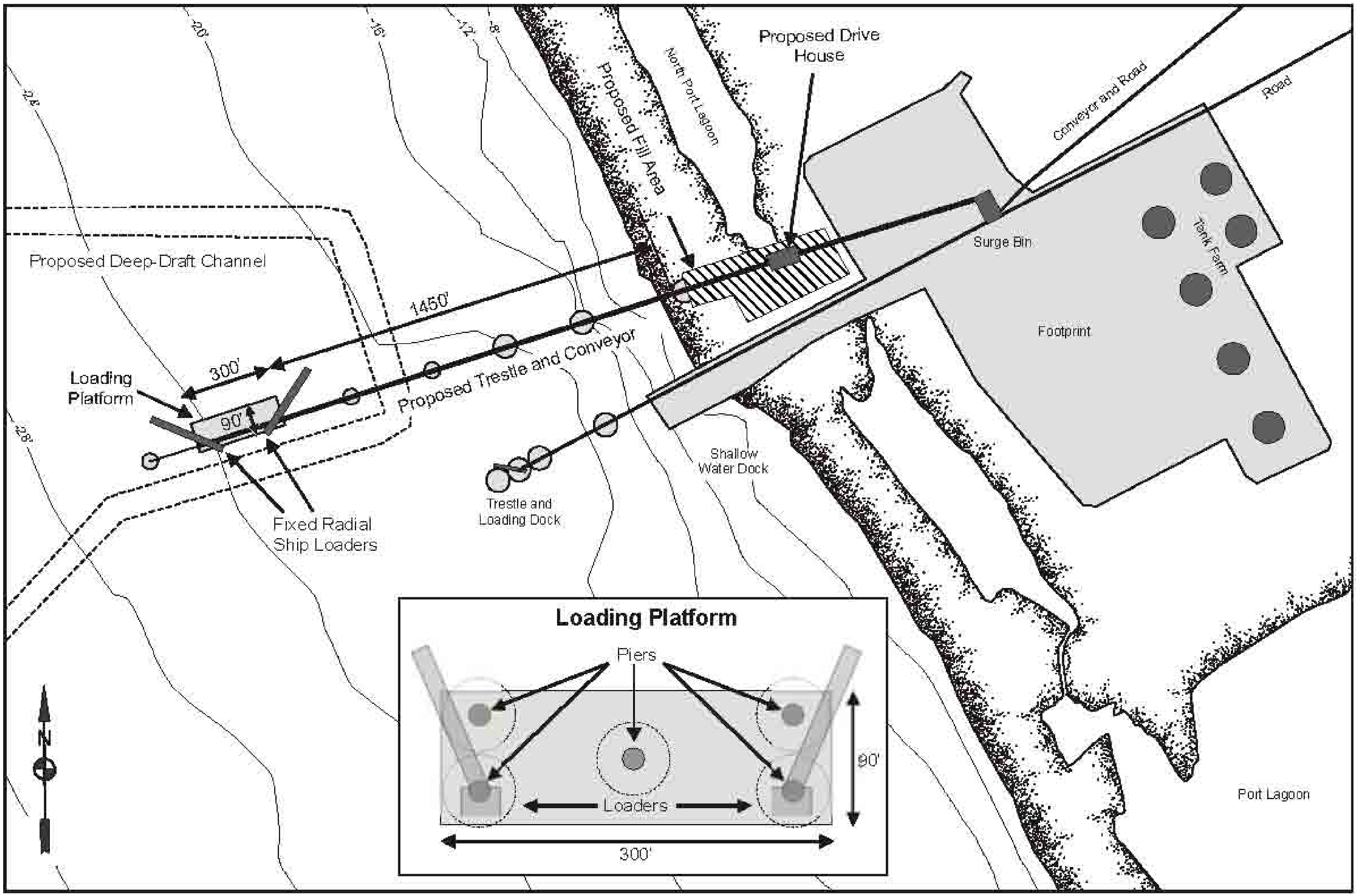

Figure 7: Potential Trestle and Loading Platform Alignment and Layout
(Source: Navigation Improvements, Draft Environmental Impact Statement, DeLong Mountain Terminal, Alaska, 2005)

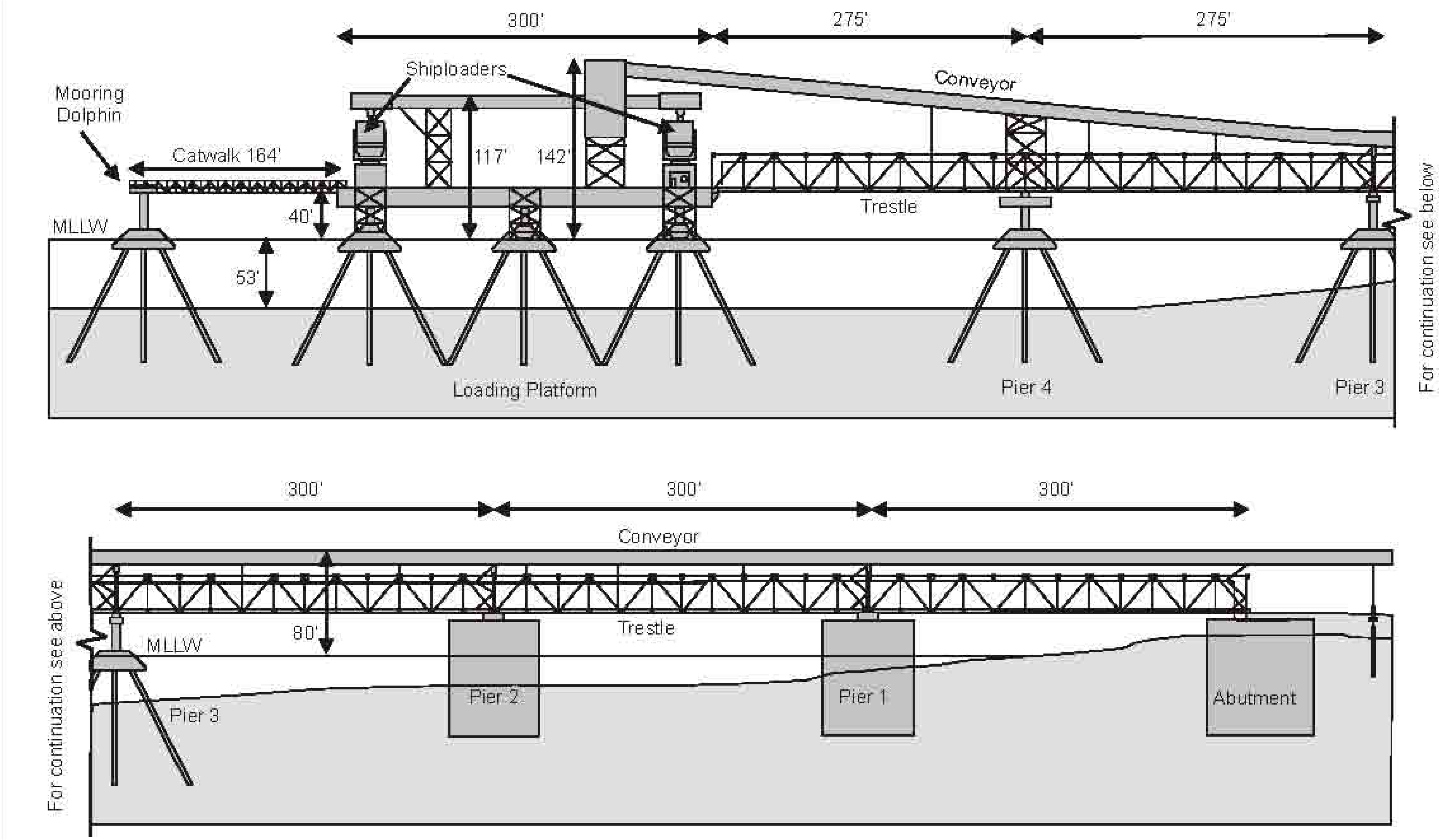

Figure 8: Side View of Potential Trestle, Platform, and Supports
(Source: Navigation Improvements, Draft Environmental Impact Statement, DeLong Mountain Terminal, Alaska, 2005)

5.1.2 DeLong Mountain Transportation System Port Development Cost Summary

The updated cost estimates for the DMTS port (Tables 1 and 2) are based on estimates provided in the Navigation Improvements, Draft Interim Feasibility Report, DeLong Mountain Terminal, Alaska, Volume I (USACE, 2005), and guidance from construction experts familiar with remote construction in western Alaska. Appendix A has detailed cost estimate worksheets and assumptions for each item summarized below.

Table 1: DeLong Mountain Transportation System Ship-Based System Estimated Cost and Contingencies, 2012

DESCRIPTION		COST
	Ore Storage Buildings	$65M
	Yard and Support Facilities	$10M
	Conveyor: Equipment and Installation	$10M
	Access Road	NA
Upland Developments	**Subtotal**	**$85M**
	Initial Dredging	$70M
	Dock	$30M
	New Barge	NA
	New Tug	NA
Offshore Developments	**Subtotal**	**$100M**
	PRE-CONTINGENCY TOTAL	**$185M**
	Contingency (40%)	$75M
ESTIMATED TOTAL CONSTRUCTION COST		**$260M**
	Annual Onshore Maintenance and Operations	$3M
	Annual Offshore Maintenance and Operations	$11M
Total Annual Maintenance Cost		**$14M**

Note: Onshore and offshore development costs have been rounded to the nearest $5M.

Table 2: DeLong Mountain Transportation System Barge-Based System Estimated Cost and Contingencies, 2012

DESCRIPTION		COST
	Ore Storage Buildings	$65M
	Yard and Support Facilities	$10M
	Conveyor: Equipment and Installation	$10M
	Access Road	NA
Upland Developments	**Subtotal**	**$85M**
	Initial Dredging	$50M
	Dock	$20M
	New Barge	$20M
	New Tug	$5M
Offshore Developments	**Subtotal**	**$95M**
	PRE-CONTINGENCY TOTAL	**$180M**
	Contingency (20%)	$35M
ESTIMATED TOTAL CONSTRUCTION COST		**$215M**
	Annual Onshore Maintenance and Operations	$3M
	Annual Offshore Maintenance and Operations	$12M
Total Annual Maintenance Cost		**$15M**

Note: Onshore and offshore development costs have been rounded to the nearest $5M.

5.1.3 Advantages

- The primary advantage of the DMTS site is the proven operating system already in place to accommodate ore concentrate shipping. Depending on volumes of ore moving through the port, it may be practical to continue to use barge-based shipping methods. If larger quantities of ore are anticipated, the port could be expanded to a ship-based operation, resulting in expedited transfers directly to the final vessel.
- Design and environmental studies of ship-based port development at this site are already at an advanced state. This existing work could expedite port development compared to the other sites under consideration.
- DMTS has existing access to upland storage, health and welfare facilities, and the jet-capable airport at Red Dog Mine, and could serve as a distressed vessel and/or spill response port.
- As a state-owned facility, DMTS could be opened to other port users within the terms of the contract with Tech, the Red Dog Mine operator.
- It is 260 miles from the DMTS port site to Ambler mineral belt; nearly the same distance as the 250 miles from Ambler mineral belt to Cape Blossom.

5.1.4 Disadvantages

- Port expansion for a ship-based site would require large amounts of material to be dredged and removed. Costs associated with the initial dredging and ongoing maintenance dredging will likely be high. Figure 9 below shows a dredged channel that is nearly three miles long, plus a turning basin that is over a half-mile long.

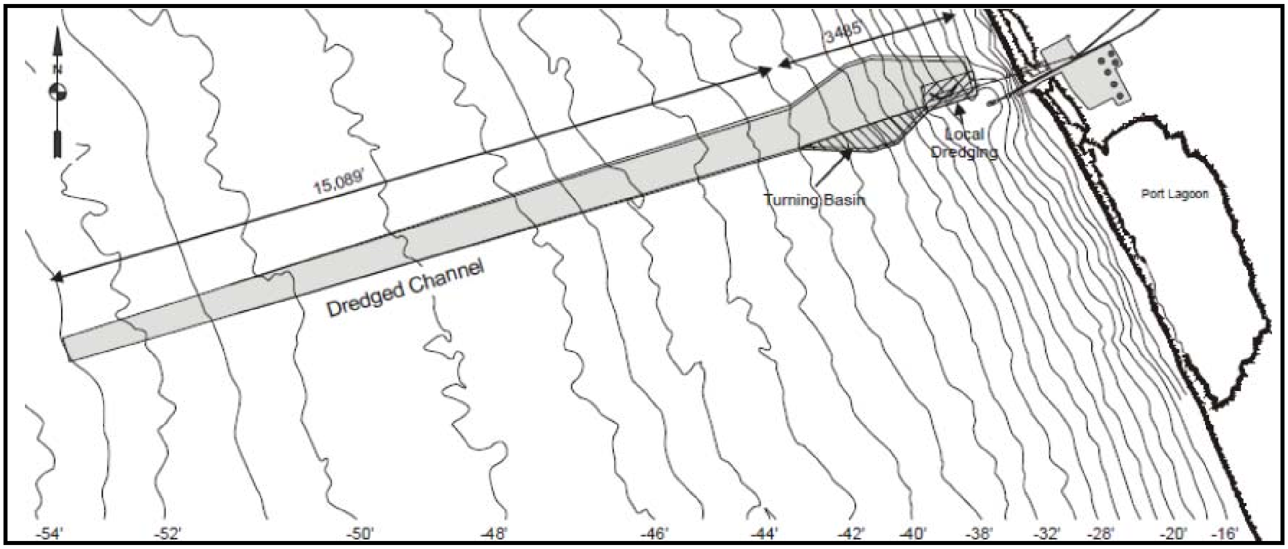

Figure 9: DeLong Mountain Transportation System Port Site Dredged Channel (Source: Navigation Improvements, Draft Environmental Impact Statement, DeLong Mountain Terminal, Alaska, 2005)

- There are few, if any, other substantial potential mineral sites between Ambler mineral belt and the DMTS port site.
- A corridor between Ambler mineral belt and DMTS may support eventual development of a road system between Kotzebue and the area villages. However, the corridor would likely be more circuitous than the corridor to the Cape Blossom site.
- Construction phasing of upgrades would need to avoid impacts to Red Dog Mine operations.

5.2 Cape Blossom Port Site

5.2.1 Site Description

This port site is 12 miles east of Kotzebue on Kotzebue Sound and is 250 miles from Ambler mineral belt. The original purpose of the site investigations by the USACE (2004) was as a new inbound fuel and freight supply port, with the goal of replacing the current lightering system at Kotzebue with a mainline-barge-capable service. The port site would require up to a 1,000-foot dock and up to a mile-long dredge channel to reach the required 24-foot operating depth required for mainline barges (Figures 10 and 11). Current bathymetric data does not indicate the capacity for ship-based operations.

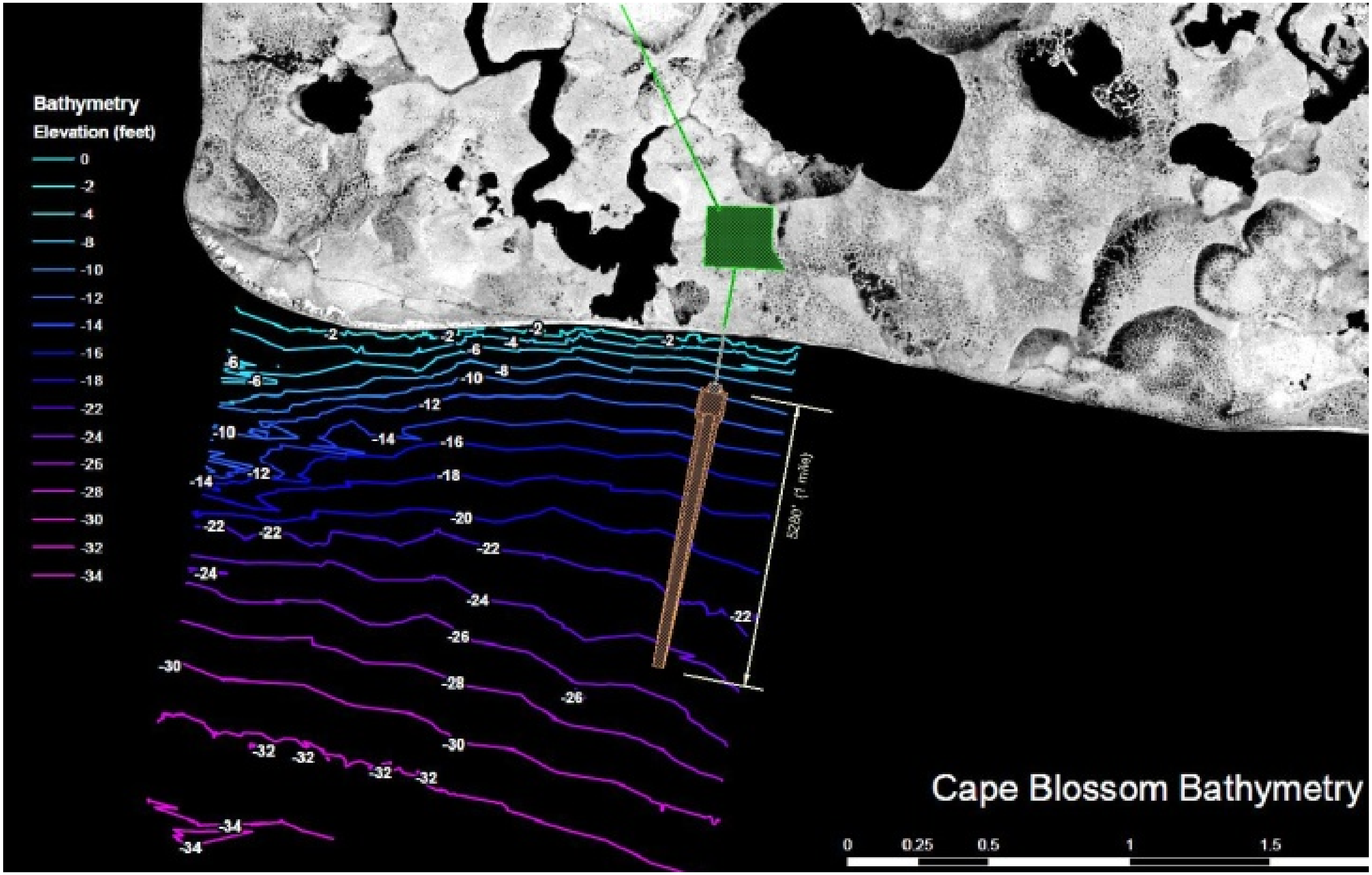

Figure 10: Cape Blossom Rendering
(Image Courtesy of Harvey Smith, DOT&PF Coastal Engineer)

Figure 11: Rendering of Potential Dock at Cape Blossom
(Image Courtesy of Harvey Smith, DOT&PF Coastal Engineer)

In the 2004 investigation, seven alternatives for the mainline barge operations were examined. Table 3 below lists the alternatives and why they were or were not used for estimating the current estimated cost. Appendix A has detailed cost estimate worksheets and assumptions for port development based on Alternative A below.

Table 3: Previously Examined Alternatives for Cape Blossom Port

Previously Examined Alternatives	Remarks
Alternative A - Dredged Channel and Pier	**Used for this cost estimate.** Deemed the most relevant to ore handling.
Alternative B - Causeway	**Not used for cost estimate.** Causeway alternatives [B and C] were rejected due to environmental constraints.
Alternative C - Channel/Causeway Combination	
Alternative D - Submarine Pipeline	**Not used for cost estimate.** Pipeline alternatives [D, E, and F] were rejected because they were intended for fuel handling, not ore handling.
Alternative E - Trestle-Supported Pipeline	
Alternative F - Floating Pipeline	
Alternative G - Lightering into Cape Blossom	**Not used for cost estimate.** Alternative [G] was rejected as too costly for ore handling.

Source: USACE, 2004

The City of Kotzebue continues work on an access road to the potential port site. To serve as a minerals export site, the dock structure would likely need a catwalk for a conveyor system or a full truck-capable dock for inbound and outbound freight. There would also be a need for an ore concentrate storage facility like the ones at the existing DMTS port site. As a minus 35-foot depth appears impractical due to the amount of dredging that would be required, this port site would be restricted to a barge-based lightering operation. Given the bathometry, the lightering operation would have to transport ore up to 6 miles offshore at Cape Blossom, compared to 1 mile at DMTS.

5.2.2 Cape Blossom Port Development Cost Summary

Costs for port development at Cape Blossom are shown in Table 4.

Table 4: Cape Blossom Estimated Cost and Contingencies, 2012

DESCRIPTION		COST
	Ore Storage Buildings	$65M
	Yard and Support Facilities	$10M
	Conveyor: Equipment and Installation	$10M
	Two Lane Access Road	$35M
Upland Developments	**Subtotal**	**$120M**
	Initial Dredging	$20M
	Dock	$20M
	New Barge	NA
	New Tug	NA
Offshore Developments	**Subtotal**	**$40M**
	PRE-CONTINGENCY TOTAL	**$160M**
	Contingency (60%)	$95M
ESTIMATED TOTAL CONSTRUCTION COST		**$255M**
	Annual Onshore Maintenance and Operations	$4M
	Annual Offshore Maintenance and Operations	$8M
Total Annual Maintenance Cost		**$12M**

Note: Onshore and offshore development costs have been rounded to the nearest $5M.

5.2.3 Advantages

- The primary advantage of the Cape Blossom port site is the site's proximity to Kotzebue and the economic benefits of the jobs and business opportunities available to the Kotzebue community.
- This site would enhance the ability to receive and distribute fuel supplies to the region.
- It would take advantage of the fully developed utilities and services in Kotzebue, including jet service.
- Coordinating ore handling operations at DMTS with Red Dog Mine operations would be a challenge, albeit one that can likely be addressed. However, if Cape Blossom were the ore transfer point for Ambler mineral belt, there would be no challenges to coordinating ore transfers.

- A road network to access Ambler mineral belt could provide the basis for an eventual road network linking Northwest Arctic Borough villages between Kotzebue and the Upper Kobuk Valley; a long standing goal of the region.

5.2.4 Disadvantages

- The primary disadvantage of the site is that it appears impractical to develop a port at this site with a depth of minus 35 feet for ship operations. It would be a barge-based facility.
- While it may be practical to operate a barge-based transshipment system from Cape Blossom, similar to the one operating at DMTS, it is important to know that the barge haul distance to ship depths in Kotzebue Sound is up to 6 miles. This compares to 1 mile at DMTS.
- The additional costs to mobilize and access for development of an upland staging area and associated minerals storage facilities may be higher than those at DMTS, which has existing facilities.
- There are few, if any, other substantial potential mineral sites between Ambler mineral belt and the port site.

5.3 Cape Darby Port Site

5.3.1 Site Description

This port site is 60 miles east of Nome on a point of land between Golovin Bay and Norton Bay. It is approximately 330 miles southwest of Ambler mineral belt by the road/rail corridor identified in the Summary Report. This port would primarily be a mining ore export port, with upland storage for ore concentrates.

The bathymetry from nautical charts shows deep water near the shore at Cape Darby. This is one of only a handful of deep draft sites in the Arctic. The site also has an extended six-month open water season, compared to the three- to four-month open water season found at the Cape Blossom and DMTS sites. The port site would require a 2- to 3-mile-long road to access the storage site and the conveyor system that transports ore to the ships (Figures 12 and 13). The upland development area, estimated at 20 acres, would require ore storage capacity, but likely at a smaller scale compared to DMTS or Cape Blossom due to the longer shipping season.

**Figure 12: Cape Darby Port Site
(Image Courtesy of Harvey Smith, DOT&PF Coastal Engineer)**

**Figure 13: Rendering of Potential Port at Cape Darby
(Image Courtesy of Harvey Smith, DOT&PF Coastal Engineer)**

5.3.2 Cape Darby Port Development Cost Summary

There are no known existing port studies with cost estimates for the Cape Darby site. The cost estimate is based on similar needs of the other port sites (Table 5). Appendix A has detailed cost estimate worksheets and assumptions for each item summarized below.

Table 5: Cape Darby Estimated Cost and Contingencies, 2012

DESCRIPTION		COST
	Ore Storage Buildings	$65M
	Yard and Support Facilities	$10M
	Conveyor: Equipment and Installation	$50M
	One Lane Access Road	$15M
Upland Developments	**Subtotal**	**$140M**
	Initial Dredging	NA
	Dock	$15M
	New Barge	NA
	New Tug	NA
Offshore Developments	**Subtotal**	**$15M**
	PRE-CONTINGENCY TOTAL	**$155M**
	Contingency (65%)	$100M
ESTIMATED TOTAL CONSTRUCTION COST		**$255M**
	Annual Onshore Maintenance and Operations	$4M
	Annual Offshore Maintenance and Operations	$6M
Total Annual Maintenance Cost		**$10M**

Note: Onshore and offshore development costs have been rounded to the nearest $5M.

5.3.3 Advantages

- The primary advantage is the near shore deep draft, which could drastically reduce construction and maintenance costs.
- The ability to bring a ship to the port for direct loading is substantially more productive and secure than the offshore lightering required for barge-based operations at the other two sites.
- A long-term advantage would be that the corridor between Ambler mineral belt and the port site would transit a known and substantial eastern Seward Peninsula mineral district. Improved access and transport of inbound products and outbound ore concentrates could accelerate development of this undeveloped mining district.

5.3.4 Disadvantages

- The primary disadvantage is the 330-mile distance to the Ambler mineral belt. This creates negative pressure on the distance-to-ore-volume/value calculation. This compares to 260 miles for the DMTS site and 250 miles for the Cape Blossom site.
- The site is more remote resulting in higher costs. In addition to the costs of developing staging areas, utilities, and minerals storage facilities, a 4,000-foot runway and housing for operations crews would likely be needed. These have not been included in this cost estimate.
- The road/rail network to access the port would not support an eventual road network linking Northwest Arctic Borough villages between Kotzebue and the mineral district.

5.4 Order-of-Magnitude Costs

The order-of-magnitude costs shown for the DMTS and Cape Blossom sites were obtained by updating cost estimates from earlier studies. No engineering design was done for these estimates. No earlier studies or earlier cost estimates were found for the Cape Darby site. The order of magnitude cost for the Cape Darby site was based on minimal engineering layout performed by DOWL HKM. For example, a yard and support facilities would clearly be needed as part of this port development. The nearest relatively flat site is slightly over two miles from the dock site (measured along the 100 foot contour). So DOWL HKM estimated the additional cost of a road and conveyor that would be slightly over two miles long.

Costs for a trestle and platform at the DMTS port site are found in the Navigation Improvements Draft Interim Feasibility Report, DeLong Mountain Terminal, Alaska, Volume I (USACE, 2005). The Square Foot dock costs found in this report appear to be significantly higher than the costs that were determined for the Cape Blossom and Cape Darby sites in Appendix A. For comparison, DOWL HKM showed two cost estimates at both the Cape Blossom and Cape Darby sites. One cost is based on Square Foot costs determined for these two sites and the second cost is based on the higher Square Foot costs from the DMTS site. This second, higher cost is provided for comparison.

These order-of-magnitude costs do not include ongoing lightering costs for barge-based operations. Ongoing lightering costs would be based, in part, on the amount of ore shipped over the dock each year.

6.0 SUMMARY AND CONCLUSIONS

Table 6 summarizes the corridors presented in the Summary Report with the order-of-magnitude costs added to the western corridors that end at a potential port location. This enables a better comparison of the primary transportation infrastructure that would be required for each access corridor.

Port development costs for a port location near Nome (Selawik Flats Corridor) were not estimated for this report. However, for comparison of corridors, the port costs estimated for Cape Darby were assumed for the Selawik Flats Corridor.

Table 6: Summary of Total Estimated Corridor Costs

SUMMARY	Brooks East	Kanuti Flats	Elliot Highway	DMTS Ship-Based	DMTS Barge-Based	Cape Blossom	Selawik Flats	Cape Darby
Total Roadway Construction Cost*	$430M	$510M	$990M	$720M	$720M	$860M	$960M	$950M
Total Port Construction Cost	NA	NA	NA	$260M	$215M	$255M	$255M	$255M
TOTALCORRIDOR CONSTRUCTION COST	**$430M**	**$510M**	**$990M**	**$980M**	**$935M**	**$1,115M**	**$1,215M**	**$1,205M**
Annual Roadway Maintenance Cost*	$9M	$9M	$14M	$10M	$10M	$9M	$13M	$13M
Annual Port Maintenance Cost	NA	NA	NA	$14M	$15M	$12M	$10M	$10M
TOTAL ROAD AND PORT ANNUAL MAINTENANCE COST	**$9M**	**$9M**	**$14M**	**$24M**	**$25M**	**$21M**	**$23M**	**$23M**

* Roadway construction and annual maintenance cost numbers were taken from the Summary Report (DOWL HKM, September 2011a) and rounded to the nearest million dollars.

7.0 REFERENCES

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APPENDIX A

Detailed Cost Work Sheets

APPENDIX INDEX

SUMMARY OF ESTIMATED PORT COSTS				
Description	**DMTS Ship-Based**	**DMTS Barge-Based**[3]	**Cape Blossom**[3]	**Cape Darby**
Ore Storage Buildings[1]	$65M	$65M	$65M	$65M
Yard & Support Facilities	$10M	$10M	$10M	$10M
Conveyor; Equipment and Installation	$10M	$10M	$10M	$50M
Access Road	NA	NA	$35M	$15M
Onshore Developments Subtotal	**$85M**	**$85M**	**$120M**	**$140M**
Dredging, First Cost	$70M	$50M	$20M	NA
Dock	$30M [4]	$20M [4]	$20M	$15M
New Barge	NA	$20M	NA	NA
New Tug	NA	$5M	NA	NA
Offshore Developments Subtotal	**$100M**	**$95M**	**$40M**	**$15M**
PRE-CONTINGENCY SUBTOTAL	**$185M**	**$180M**	**$160M**	**$155M**
Contingency[2]	40%	20%	60%	65%
Total Contingency	$75M	$35M	$95M	$100M
ESTIMATED TOTAL CONSTRUCTION COSTS	**$260M**	**$215M**	**$255M**	**$255M**
ESTIMATED TOTAL ANNUAL MAINTENANCE COSTS	**$14M**	**$15M**	**$12M**	**$10M**
Annual Onshore Maintenance and Operations	$3M	$3M	$4M	$4M
Annual Offshore Maintenance and Operations	$11M	$12M	$8M	$6M

[1] Cost does not include, mob & demob or access. These costs are reflected in the engineering uncertainty contingency.

[2] Contingencies include; engineering uncertainty, management, administration, and owner contingency. See page A-3.

[3] Does not include ongoing costs for lightering.

[4] The square foot (SF) dock cost applied at the Cape Darby and Cape Blossom sites was determined through conversations with two experienced Alaskan port engineers. However, the SF dock cost for the DMTS site found in the Navigation Improvements, Draft Interim Feasibility Report, DeLong Mountain Terminal, Alaska, Volume I (USCAE, 2005) is significantly higher. To allow for an equal comparison, the SF docks cost applied to Cape Darby and Cape Blossom ($1,000/SF) was also applied to the DMTS docks. For more information, see Appendix A.

Producer Price Index and Contingencies

1. PRODUCER PRICE INDEX

Description: Some port location have past studies with estimates that date back to 2004 and 1981. To bring those numbers up to 2012 for comparison, a Producer Price Index number (PPI) was used to determine a PPI multiplier.

Source: Bureau of Labor Statistics data; http://data.bls.gov/pdq/SurveyOutputServlet

1981 Annual PPI	96.1	**Source:** *Bureau of Labor Statistics data; http://data.bls.gov/pdq/SurveyOutputServlet*
2004 Annual PPI	148.5	**Source:** *Bureau of Labor Statistics data; http://data.bls.gov/pdq/SurveyOutputServlet*
2012 Annual PPI	201.8	Extrapolated from data/source provided above.
2012 PPI Multiplier (from 2004)		**1.36**
2012 PPI Multiplier (from 1981)		**2.10**

2. CONTINGENCIES

Description: Some port locations have past studies with contingencies already included in specific items. Therefore added contingencies vary by port and are summarized below.

Description	DMTS Ship-Based	DMTS Barge-Based	Cape Blossom	Cape Darby
Engineering, Management, and Administration	20%[1]	20%[1]	20%	20%
Engineering Uncertainty	25%	10%	30%	35%
Owner Contingency	15%	10%	10%	10%
Total Contingency added to Construction Cost	**40%**	**20%**	**60%**	**65%**

[1]Highlighted contingencies are not included in total contingency calculation. These contingencies are already included in the construction cost unit price from past studies.

ONSHORE DEVELOPMENT COSTS

This Category of Costs include the following:
1. Ore Storage Buildings
2. Yard & Support facilities
3. Conveyor; Equipment and Installation
4. Access Road

1. ORE STORAGE BUILDINGS COSTS

Ore Storage Buildings Description: Concrete spread footings, concrete "bin" walls at the building exterior, explosion-proof lighting, non-insulated steel siding [zinc coated], no heat, air circulation equipment, interior conveyor.

Note: The existing DMTS port would require additional storage and facilities to accommodate new ore shipments. Therefore, the same onshore development needs are assumed for the existing DMTS port as for Cape Darby and Cape Blossom. However, the cost for mobilization & demobilization, existing access, etc will be less at DMTS. This cost reduction is reflected in the contingencies (i.e. Engineering uncertainty is lower for the DMTS ports then Cape Darby and Cape Blossom).

Description	Building 1	Building 2	Interior Conveyor	Remarks
Length	1,425 ft	1,200 ft	$6,000,000	Building sizes were estimated using the existing Red Dog Mine facilities. See note above.
Width	218 ft	218 ft		
Unit Cost	$100 /sf	$100 /sf		
TOTAL	**$31,065,000**	**$26,160,000**	**$6,000,000**	**$65,000,000**

ONSHORE DEVELOPMENT COSTS

2. YARD & SUPPORT FACILITIES

Description: This cost assumes a 20-acre site. The site was assumed to be graded for surface drainage with settling basins, but no buried drainage system. It was assumed to have minimal outdoor lighting, a small administration building, a small maintenance building, a well, and a septic system. The area will be unpaved, with a 6-inch mat of rock and sand.

Source: Louis Berger & Associates, Inc. Western and Arctic Alaska Transportation Study, Phase III: Project Evaluation, Final Report, Volume III: Marine Infrastructure. Prepared for the State of Alaska Department of Transportation and Public Facilities, May 1981, pp. 4-196.

The cost estimate from this 1981 report was updated to 2012 values by applying a Producer Price Index (PPI) multiplier of 2.10.

Construction Cost 20 Acres (1981)	$968,000	1981 report was $484,000 for 10 acres
Construction Cost Facilities (1981)	$3,049,000	Cost for water, fuel, electricity, lighting, transit shed, admin building, and fuel storage.
PPI Multiplier (2012)	2.10	**To nearest $5M**
Construction Cost (2012)	**$8,440,000**	**$10,000,000**

3. CONVEYOR; EQUIPMENT AND INSTALLATION COSTS

Description: Assumptions for conveyor system equipment include: 6-foot wide conveyor above grade [on piers], 60-inch wide belt, walkway on one side of conveyor, enclosed. The conveyor system installation cost is assumed to be 50% of conveyor equipment costs.

Conveyor Equipment				
Description	**DMTS Ship-Based**	**DMTS Barge-Based**	**Cape Blossom**	**Cape Darby**
Length	0.5 miles	0.5 miles	0.5 miles	2.4 miles
Unit Cost	$2,500 /ft	$2,500 /ft	$2,500 /ft	$2,500 /ft
Total Equipment Cost	**$6,600,000**	**$6,600,000**	**$6,600,000**	**$31,680,000**
Conveyor Installation Cost (ASSUMES 50% OF EQUIPMENT COST)				
Installation Costs	**$3,300,000**	**$3,300,000**	**$3,300,000**	**$15,840,000**
TOTAL CONVEYOR COST	$9,900,000	$9,900,000	$9,900,000	$47,520,000
Rounded to Nearest $5M	**$10,000,000**	**$10,000,000**	**$10,000,000**	**$50,000,000**

ONSHORE DEVELOPMENT COSTS

4a. ONE LANE ACCESS ROAD (Cape Darby Only)

Description: The proposed dock at Cape Darby is about 2 miles from a relatively flat site. Consequently, an access road will be needed between the proposed dock and the landside yard and support facilities.
Two different $/mile costs were calculated for the one-lane access road. The first segment of road runs about 8,500 LF [≈ 1.6 miles] from the dock toward the landside yard. This section of road will have a steep side slope and significant rock cut. The assumed unit cost of this section of road was $8.1M/ mile, based on DOWL HKM's ongoing road design in Akutan, Alaska.

The second segment of road continues an additional 3,200 LF [≈ 0.6 miles] to the landside yard. This section has a much flatter cross slope and would require less rock excavation. The assumed unit cost of this road section is $2.3/mile, derived from the Single-Lane Corridor Analysis Report (DOWL HKM 2012) cost estimate for Cape Darby.

Length in mountainous and rocky terrain.	1.6 miles	$ 8,100,000 /mile
Length in level terrain (less rock excavation)	0.6 miles	$ 2,300,000 /mile
Total Access Road Construction Cost	**$15,000,000 CAPE DARBY ONLY**	

4b. TWO LANE ACCESS ROAD (Cape Blossom Only)

Description: It is assumed that a 12-mile long, two-lane access road will be needed between Kotzebue and the Cape Blossom site. This access road will not be part of the Ambler Mining District Access project, so its cost is being included in the new port cost estimate. The assumed unit cost of this road section is $2.8/mile, derived from the Baseline Cost Memorandum (DOWL HKM 2011) for the Cape Blossom Corridor.

Length	12.0 miles	$ 2,900,000 /mile
Total Access Road Construction Cost	**$35,000,000 CAPE BLOSSOM ONLY**	

DMTS PORT DEVELOPMENT COSTS - SHIP-BASED		
TOTAL ESTIMATED CONSTRUCTION COST SUMMARY		
OFFSHORE DEVELOPMENT	$100,000,000	
ONSHORE DEVELOPMENT	$85,000,000	
SUBTOTAL	$185,000,000	**Rounded to Nearest $5M**
CONTINGENCY (40%)	$74,000,000	**$75,000,000**
TOTAL	$259,000,000	**$260,000,000**

OFFSHORE CONSTRUCTION COSTS: dredging, and trestle and platform

Dredge (First) Cost (2004)	$52,000,000	**Source:** *Navigation Improvements, Draft Interim Feasibility Report, DeLong Mountain Terminal, Alaska; Volume II; Army Corps of Engineers, Alaska District; September, 2005. See Appendix "C".* **Note:** The 2004 estimate includes cost for the initial construction of a fuel storage tank and fuel handling. These cost were not included in this report, since the purpose of this study is not to move additional fuel.
PPI Multiplier (2012)	1.36	
Dredge (First) Cost (2012) Rounded to the nearest $5M	**$70,000,000**	
Trestle & Platform Cost (2004)	$96,041,437	
PPI Multiplier (2012)	1.36	

Note: Two estimated "dock" costs are shown below for comparison. 1) The first is based on the trestle & loading platform for the DMTS Ship-based port that appears high at ~$4,500/sqft. 2) The second cost is based on discussions with two Alaska port engineers who are familiar with port construction costs, ($1,000/ft^2).

Trestle & Platform Cost (2012) Rounded to the nearest $5M	$130,000,000	**~ $4,500 /sqft**
Dock (1,450 ft x 20 ft)		
New Dock (2012)	**$30,000,000**	Cost information is based on discussions with two Alaska port engineers who are familiar with port construction costs. Assumes unit cost of $1,000/ft^2.
Total OFFSHORE Construction Costs (Rounded to nearest $5M)		**$100,000,000**

DMTS PORT DEVELOPMENT COSTS - SHIP-BASED

ONSHORE DEVELOPMENT COSTS SUMMARY (See calculations on pages A-4 through A-6.)

1. Ore Storage Buildings	$65,000,000	**TOTAL ONSHORE COST**
2. Yard & Support Facilities	$10,000,000	**$85,000,000**
3. Conveyor; Equipment and Installation	$10,000,000	

ANNUAL COSTS

Annual Offshore Dredging and Maintenance and Operations.

Annual Dredging Cost (2004)	$1,245,000	**Source:** *Navigation Improvements, Draft Environmental Impact Statement, DeLong Mountain Terminal, Alaska; Volume I; Army Corps of Engineers, Alaska District; September, 2005, page 47.*
PPI Multiplier (2012)	1.36	
Annual Dredging Cost (2012)	**$1,700,000**	
Annual Offshore Maintenance & Operations Cost (2004)	$6,550,000	**Source:** *Navigation Improvements, Draft Environmental Impact Statement, DeLong Mountain Terminal, Alaska; Volume I; Army Corps of Engineers, Alaska District; September, 2005, page 47.*
PPI Multiplier (2012)	1.36	
Annual Offshore Maintenance & Operations Cost (2012)	**$8,910,000**	
TOTAL ANNUAL M&O OFFSHORE COSTS	**$10,610,000**	

Annual Onshore Maintenance and Operations.

Annual Port Infrastructure Costs	**$2,550,000**	Assumes 3% of Onshore Construction Costs. **Source:** *Louis Berger & Associates, Inc. May 1981. Western and Arctic Alaska Transportation Study, Phase III, Volume III: Pg 4-185.*

CONTINGENCIES

Engineering, Management, and Administration	20%[1]	[1]Contingency is not included in total contingency calculation as it is already included in the construction cost unit price from past studies.
Engineering Uncertainty	25%	
Owner Contingency	15%	
Total Contingency added to Construction Cost	**40%**	

DMTS PORT DEVELOPMENT COSTS - BARGE BASED

TOTAL ESTIMATED CONSTRUCTION COST SUMMARY

OFFSHORE DEVELOPMENT	$95,000,000	
ONSHORE DEVELOPMENT	$85,000,000	
SUBTOTAL	**$180,000,000**	**Rounded to Nearest $5M**
CONTINGENCY (20%)	$36,000,000	**$35,000,000**
TOTAL	**$216,000,000**	**$215,000,000**

OFFSHORE CONSTRUCTION COSTS: Barge, tug and trestle

Construction Cost Barge (2004)	$14,700,000	**Barge & Tug, Source:** *Navigation Improvements, Draft Environmental Impact Statement, DeLong Mountain Terminal, Alaska; Volume I; Army Corps of Engineers, Alaska District; Appendices; September, 2005, page 32.*
Construction Cost Barge (2012)	$19,992,000	
Construction Cost Tug (2004)	$4,500,000	
Construction Cost Tug (2012)	$6,120,000	
Cost Barge & Tug (2012)	**$25,000,000**	
Dredging Cost (2004)	$36,400,000	**Dredging Assumption:** A barge-based operation would require a shorter Trestle & Loading Platform and less dredging than a ship-based operation due to the ability to navigate in shallower water. Dredging costs were assumed using the ship-based dredging costs reduced by 30%.
Dredging Cost (2012)	**$49,504,000**	
PPI Multiplier (2012)	1.36	

Note: Two estimated "dock" costs are shown below for comparison. 1) The first is based on the trestle & loading platform for the DMTS Ship-based port that appears high at ~$4,500/sqft. 2) The second cost is based on discussions with two Alaska port engineers who are familiar with port construction costs, ($1,000/ft^2).

Trestle: 1,000 ft x 20 ft		
New Trestle & Platform(2012)	$90,000,000	Assumes DMTS Ship-based unit cost of $4,500/ft^2.
Dock (1,000 ft x 20 ft)		
New Dock (2012)	**$20,000,000**	Cost information is based on discussions with two Alaska port engineers who are familiar with port construction costs. Assumes unit cost of $1,000/ft^2.
Total OFFSHORE Construction Costs (Rounded to nearest $5M)		**$95,000,000**

DMTS PORT DEVELOPMENT COSTS - BARGE BASED

ONSHORE DEVELOPMENT COSTS SUMMARY (See calculations on pages A-4 through A-6.)

1. Ore Storage Buildings	$65,000,000	
2. Yard & Support Facilities	$10,000,000	**$85,000,000**
3. Conveyor; Equipment and Installation	$10,000,000	

ANNUAL COSTS

Annual Offshore Dredging and Dock Maintenance and Operations.

Annual Dredging Cost (2004)	$1,245,000	**Source:** *Source: Navigation Improvements, Draft Environmental Impact Statement, DeLong Mountain Terminal, Alaska; Volume I; Army Corps of Engineers, Alaska District; September, 2005, page 47.*
PPI Multiplier (2012)	1.36	
Annual Dredging Cost (2012)	**$1,700,000**	
Annual Maintenance & Operations Cost (2004)	$6,550,000	**Source:** *Source: Navigation Improvements, Draft Environmental Impact Statement, DeLong Mountain Terminal, Alaska; Volume I; Army Corps of Engineers, Alaska District; September, 2005, page 47.*
PPI Multiplier (2012)	1.36	
Annual Maintenance & Operations Cost (2012)	**$8,910,000**	
Barge & Tug Annual Costs M&O	**$1,305,600**	Unknown. DOWL HKM assumed 5% of initial construction cost.
TOTAL OFFSHORE ANNUAL M&O	**$11,915,600**	

Annual Onshore Maintenance and Operations.

Annual Port Infrastructure Costs	**$2,550,000**	Assumes 3% of Onshore Construction Costs. **Source:** *Louis Berger & Associates, Inc. May 1981. Western and Arctic Alaska Transportation Study, Phase III, Volume III: Pg 4-185.*

CONTINGENCIES

Engineering, Management, and Administration	20%[1]	[1]Contingency is not included in total contingency calculation as it is already included in the construction cost unit price from past studies.
Engineering Uncertainty	10%	
Owner Contingency	10%	
Total Contingency added to Construction Cost	**20%**	

CAPE BLOSSOM PORT DEVELOPMENT COSTS

TOTAL ESTIMATED CONSTRUCTION COST SUMMARY

OFFSHORE DEVELOPMENT	$40,000,000
ONSHORE DEVELOPMENT	$120,000,000
SUBTOTAL	**$160,000,000**
CONTINGENCY (60%)	$96,000,000
TOTAL	**$256,000,000**

OFFSHORE CONSTRUCTION COSTS: Dredged channel comparison from 1981 to 2004 study, and Pier/Trestle Platform

Construction Cost Comparison: Dredged channel

Construction Cost (2004)	$13,200,000	**Source:** *Cape Blossom Improvements, U.S. Army Corps of Engineers, Alaska District; January 2004. Page 13 and B-5.* **Note:** *The 2004 and 1981 dredging estimates were escalated to 2012 for comparison. The 2004 estimate is used for the final cost estimate and assumes 1.63 million cubic yards.*
PPI Multiplier (2012)	1.36	
Construction Cost (2012)	**$17,960,000**	
Construction Cost (1981)	$8,281,000	**Source:** *Louis Berger & Associates, Inc. Western and Arctic Alaska Transportation Study, Phase III: Project Evaluation, Final Report, Volume III: Marine Infrastructure. Prepared for the State of Alaska Department of Transportation and Public Facilities, May 1981, pp 4-196.*
PPI Multiplier (2012)	2.10	
Construction Cost (2012)	$17,400,000	

Note: Three estimated "dock" costs are shown below for comparison. 1) The first cost is based on the Pier option presented in the Cape Blossom navigation Improvements report referenced below. 2) The second is based on the trestle & loading platform for the DMTS Ship-based port. The adjustment in cost is based on the length of dock needed at Cape Blossom (1,000 ft). The DMTS trestle and loading platform cost was $4,500/ft^2. The square foot cost is considerably higher than the first cost, so it is shown for comparison. 3) The third cost is based on discussions with two Alaska port engineers who are familiar with port construction costs, ($1,000/ft^2).

Pier (includes mobilization and owner costs and contingency).		
Construction Cost(2004)	$15,740,000	**Source:** *Cape Blossom Navigation Improvements, U.S. Army Corps of Engineers, Alaska District; January 2004. Pages 13 and B-5. $28.9M - $13.2M = $15.7M*
PPI Multiplier (2012)	1.36	
Construction Cost (2012)	**$21,410,000**	
Trestle Comparison (1,000 ft x 20 ft)		
New Trestle & Platform (2012)	$90,000,000	Assumes DMTS Ship-based unit cost of $4,500/ft^2. Length = 1,000 ft x 20 ft (USACE 2004)
Dock (1,000 ft x 20 ft)		
New Dock (2012)	**$20,000,000**	Cost information is based on discussions with two Alaska port engineers who are familiar with port construction costs. Assumes unit cost of $1,000/ft^2.
Total OFFSHORE Construction Costs (Rounded to nearest $5M)		**$40,000,000**

CAPE BLOSSOM PORT DEVELOPMENT COSTS

ONSHORE DEVELOPMENT COSTS SUMMARY (See calculations on pages A-4 through A-6.)		
1. Ore Storage Buildings	$65,000,000	**$120,000,000**
2. Yard & Support Facilities	$10,000,000	
3. Conveyor; Equipment and Installation	$10,000,000	
4. Two Lane Access Road	$35,000,000	

ANNUAL COSTS		
Annual Offshore Dredging and Dock Maintenance and Operations.		
Annual Dredging Cost (2004)	$1,170,000	**Source:** *Cape Blossom Navigation Improvements, U.S. Army Corps of Engineers, Alaska District; January 2004. Page 13.*
PPI Multiplier (2012)	1.36	
Annual Dredging Cost (2012)	**$1,600,000**	
Annual Maintenance & Operations Cost (2004)	$4,500,000	**Source:** Cape Blossom Navigation Improvements, U.S. Army Corps of Engineers, Alaska District; January 2004. Page 13.
PPI Multiplier (2012)	1.36	
Annual Maintenance & Operations Cost (2012)	**$6,120,000**	
TOTAL ANNUAL M&O OFFSHORE	**$7,720,000**	
Annual Onshore Maintenance and Operations.		
Annual Port Infrastructure Costs	**$3,600,000**	Assumes 3% of Onshore Construction Costs. **Source:** *Louis Berger & Associates, Inc. May 1981. Western and Arctic Alaska Transportation Study, Phase III, Volume III: Pg 4-185.*

CONTINGENCIES	
Engineering, Management, and Administration	20%
Engineering Uncertainty	30%
Owner Contingency	10%
Total Contingency added to Construction Cost	**60%**

CAPE DARBY PORT DEVELOPMENT COSTS

TOTAL ESTIMATED CONSTRUCTION COST SUMMARY

OFFSHORE DEVELOPMENT	$15,000,000	
ONSHORE DEVELOPMENT	$140,000,000	
SUBTOTAL	**$155,000,000**	**Rounded to Nearest $5M**
CONTINGENCY (65%)	$100,750,000	**$100,000,000**
TOTAL	**$255,750,000**	**$255,000,000**

Assumptions: There are no known existing port studies with cost estimates for the Cape Darby site.

OFFSHORE CONSTRUCTION COSTS: Dock

Description: Two estimated "dock" costs are shown below for comparison. 1) The first cost is based on discussions with two Alaska port engineers who are familiar with port construction costs. 2) The second is based on the trestle & loading platform for the DMTS Ship-based port. The adjustment in cost is based on the 900 ft length of dock needed at Cape Darby. The DMTS trestle and loading platform cost was $4,500/ft^2$. This square foot cost is considerably higher than the first cost, so it is shown for comparison.

Dock Dimensions	L = 900 ft	W = 20 ft	The dock length was assumed by estimating the distance from shore that is needed to obtain a 45-foot water depth. Underwater contours were taken from nautical charts. No bathymetric survey data is available.
Near-shore average water depth (Assume Half of Dock L = 450 LF)	d = 20 ft	$700 /sqft	
Seward average water depth (Assume Half of Dock L = 450 LF)	d = 40 ft	$1,000 /sqft	
Total Dock Cost Rounded to Nearest $5M	**$15,000,000**		Cost information is based on discussions with two Alaska port engineers who are familiar with port construction costs.

Trestle Comparison (900 ft x 20 ft)		
New Trestle & Platform (2012)	$81,000,000	Assumes DMTS Ship-based unit cost of $4,500/ft^2$. Length = 900 ft x 20 ft.

ONSHORE DEVELOPMENT COSTS (See calculations on pages A-4 through A-6.)

1. Ore Storage Buildings	$65,000,000	**$140,000,000**
2. Yard & Support Facilities	$10,000,000	
3. Conveyor; Equipment and Installation	$50,000,000	
4. One Lane Access Road	$15,000,000	

CAPE DARBY PORT DEVELOPMENT COSTS

ANNUAL COSTS		
Annual Offshore Dredging and Dock Maintenance and Operations.		
Annual Maintenance & Operations Cost (2004)	$4,500,000	**Source:** Cape Blossom Navigation Improvements, U.S. Army Corps of Engineers, Alaska District; January 2004. Page 13.
PPI Multiplier (2012)	1.36	
Annual Maintenance & Operations Cost (2012)	**$6,120,000**	
TOTAL ANNUAL M&O OFFSHORE	**$6,120,000**	
Annual Onshore Maintenance and Operations.		
Annual Port Infrastructure Costs	**$4,200,000**	Assumes 3% of Onshore Construction Costs. **Source:** *Louis Berger & Associates, Inc. May 1981. Western and Arctic Alaska Transportation Study, Phase III, Volume III: Pg 4-185.*

CONTINGENCIES		
Engineering, Management, and Administration	20%	
Engineering Uncertainty	35%	
Owner Contingency	10%	
Total Contingency added to Construction Cost	**65%**	

Ambler Mining District Access